NPS PHOTO AND GRAPH

## Monitoring glacier change in the North Cascades

*by Rob Burrows and Jon Riedel*

Glaciers in North Cascades National Park, Washington, have retreated rapidly for most of the past 150 years, with a 44% reduction in ice cover. However, steady retreat has slowed periodically because of 5- to 10-year-long cold and wet periods, including 1997 to the present. More than 300 glaciers in North Cascades National Park and its contiguous units, Lake Chelan National Recreation Area and Ross Lake National Recreation Area, are vital components of Pacific Northwest aquatic and terrestrial ecosystems and hydrologic systems. These glaciers influence stream flows, flooding, soil development, vegetation distribution, water quality, and water delivery to hydroelectric projects, and are important indicators of climate change.

The National Park Service has monitored mass balance on three glaciers in North Cascades National Park since 1993 (four since 1995), tracking total winter snow accumulation and summer melt. In 2002, above-average winter snowfall led to minor growth of three of the four glaciers. Glaciers provided up to 40% total summer stream runoff and meltwater during extremely dry conditions in late summer and throughout the fall, helping maintain flows for threatened salmon species. Annual variations in balance match other glacier studies and climate records in the Pacific Northwest and are correlated to climate indexes such as El Niño, or Southern Oscillation, and the Pacific Decadal Oscillation.

Partners providing data, funding, and volunteers include the Earthwatch Institute, Seattle City Light, the USDA Natural Resource Conservation Service, and the U.S. Geological Survey. Natural Resource Challenge funding is integral to the stability of this program. In 2002 the Challenge also funded initiation of a glacier monitoring program at Mount Rainier National Park, with another to begin in one to two years at Olympic National Park. ■

**rob_burrows@nps.gov**
Physical Science Technician, and Jon Riedel,

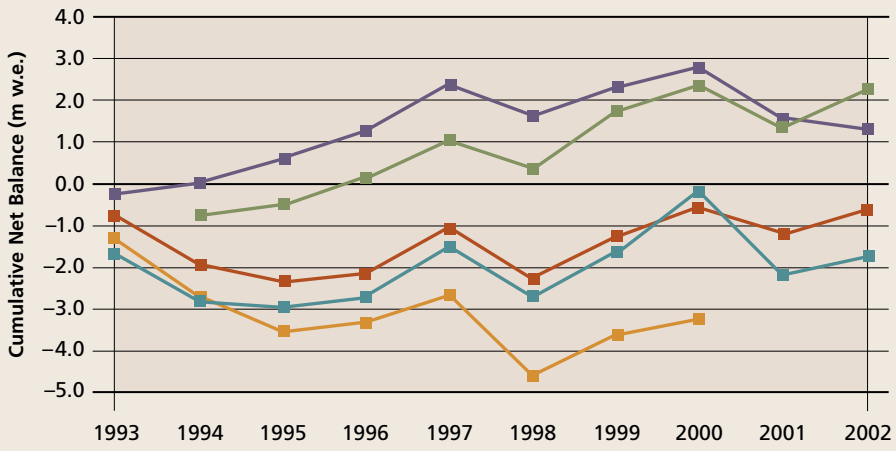
**jon_riedel@nps.gov**
Park Geologist, North Cascades National Park, Washington

**Legend**

- Noisy
- Silver
- North Kiawatti
- Sandalee
- South Cascade

"m w.e." stands for meters of meltwater equivalent

### CUMULATIVE GLACIER CHANGE IN THE NORTH CASCADES



AWARD-WINNER PROFILE

## Tonnessen finds success as CESU coordinator

COURTESY OF KATHY TONNESSEN

Kathy Tonnessen

Dr. Kathy Tonnessen describes herself as tenacious, smart, organized, and persistent. And she's right on. All these attributes have contributed to her success as research coordinator of the Rocky Mountains Cooperative Ecosystem Studies Unit (CESU). For her accomplishments in this new role Kathy won the Director's Award for Natural Resource Research in 2002.

Two years ago Kathy was selected by the National Park Service as one of its first CESU coordinators in the country. After relocating to Missoula, Montana, her task was to assemble a team of researchers and technical specialists through the University of Montana with whom the National Park Service could collaborate on park research questions. Then she had to find creative ways to fund the variety of research projects from the 15 national parks served by this CESU. Kathy says it was not an easy task: "It was just starting from scratch. There were no people, no organization; it was a lot of work."

The role Kathy plays now has been called "marriage broker"; she brings together parks that need research with scientists who need field time. The resulting partnership of the Rocky Mountains CESU is functioning well and has addressed many national issues, such as wildlife and fishery diseases, management of ungulate populations, air quality, exotic plant management, and threatened and endangered species.

Kathy's work with the Rocky Mountains CESU has set a high standard after which other CESUs are being modeled. ■

## Elk effects and management considerations studied at Rocky Mountain

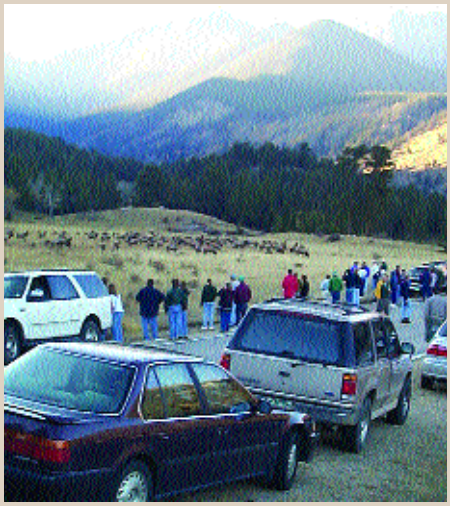
*by Therese Johnson*

Elk management in Rocky Mountain National Park (Colorado) is a complex issue that has concerned park managers and the public for many decades. Elk migrate outside the park seasonally, necessitating a regional management approach among various agencies responsible for land and wildlife management, each with its own objectives and management constraints. The issue is complicated by interactions among multiple natural resources and the residual impacts of historical land use and wildlife management practices. It is controversial because of value conflicts among stakeholders regarding desirable elk numbers and the acceptability of the management actions required for ecosystem restoration.

In 2002 the National Park Service and the U.S. Geological Survey completed a large-scale research initiative designed to assess the role of elk and other factors (e.g., hydrology, climate, forage competition, predation) in influencing ecosystem conditions. Numerous investigators conducted 13 interdisciplinary yet integrated studies using both field study and computer modeling approaches.

Results suggest the current elk population is larger and more concentrated than would be expected under natural conditions. The field studies show that willows (*Salix* spp.) have declined on the core elk winter range because of a variety of factors, including intense foraging by elk and changes in water flow and levels related to large declines in beaver. Model results predict that further shifts from biologically diverse willow and aspen communities to less diverse grasslands will occur if elk browsing is not reduced. The model also predicts that restoring natural conditions will require a combination of long-term, intensive management actions to redistribute and reduce elk numbers, restrict elk access to willow and aspen communities, and restore hydrologic conditions. The research results provide the strong scientific basis that will be critical to making and successfully implementing management decisions in the future. Rocky Mountain is developing an Elk and Vegetation Management Plan/Environmental Impact Statement in cooperation with other agencies responsible for land and wildlife management in the region. ■

**therese_johnson@nps.gov**
Biologist, Rocky Mountain National Park, Colorado



COPYRIGHT KARL CORDOVA

PARTNERSHIP PROFILE

NPS PHOTO

Park Flight coordinator Carol Beidleman (left) with Mexican colleagues: monitoring expert and professor Fernando Villaseñor Gómez and environmental educator Aída Hernández Fernández.

## A model for international conservation of birds

*by Gary Johnston*

The coordination of the Park Flight Migratory Bird Program (see page 31) is made possible through the Desert Southwest CESU, hosted by the University of Arizona. Through the CESU, Research Specialist Carol Beidleman devotes her considerable knowledge, experience, and capacity to the program, the National Park Service, and the other program partners. As a former NPS employee, she understands and appreciates the NPS mission and operations. Additional experience with The Nature Conservancy and involvement with Partners in Flight honed her program coordination skills and ability to develop effective partnerships for international migratory bird conservation. The CESU model is effective in giving her the flexibility and autonomy necessary to coordinate the activities of the many program partners. Carol and her program are examples of successful international conservation efforts. ■

**gary_johnston@nps.gov**
Washington Liaison, Biological Resources Management Division, Washington, D.C.

NPS PHOTO

Trace fossils such as these feeding structures reveal life habits and activities of extinct animals and plants and give clues to ancient environments. Worm cast fossils record the size and activities of animals whose soft body parts would not otherwise be preserved.

## Survey adds to understanding of ancient life-forms

*by Elaine Hale*

Under Wyoming's summer sun in August 2002, an interdisciplinary, interagency team conducted a paleontological survey of the middle Cambrian exposures on Trilobite Point in Yellowstone National Park that added to the scientific understanding of ancient life-forms and their environments. The research effort also built on the National Park Service's growing commitment to partnerships; paleontologists from Fossil Butte National Monument (Wyoming), the Smithsonian Institution's National Museum of Natural History, the Yellowstone Gateway Museum, and Russia joined park professionals on the research team. The Yellowstone Park Foundation provided project funding.

The survey team identified numerous fossil-bearing locations that yielded a diverse collection of species, including three distinct genera of trilobites, early arthropods. Previous research on trilobites found on Yellowstone National Park's Mount Holmes contributed to the development of speciation theories for these organisms. Brachiopods, hyoliths, fossil fragments of sponge spines, and crinoids were also collected. Trace fossils of worm burrows and tracks provided evidence of animal behavior that gives clues to ancient environments. The inventory clearly demonstrates that the sedimentary rocks of the Cambrian period in Yellowstone possess fossil information concerning the "Cambrian Explosion," the relatively sudden appearance of complex multicellular organisms. The baseline information gathered by the survey gives researchers, resource managers, and resource protection rangers a better understanding of fossil resources and the threats facing them. A full report of the project will be available in May 2003; the collected specimens will be available for research and display at the new Yellowstone Heritage and Research Center, to be completed by summer 2004. ■

**elaine_hale@nps.gov**
Acting Chief of Paleontology, Yellowstone Center for Resources

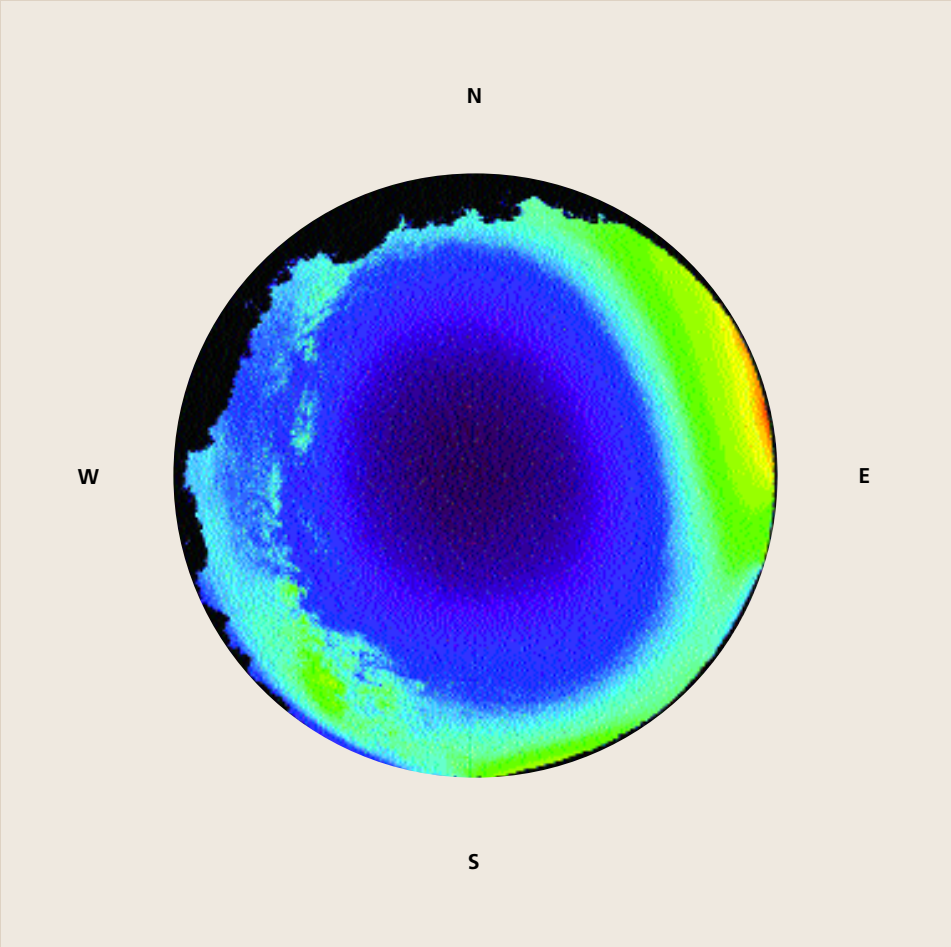
## Monitoring and preserving dark skies

*by Chad Moore and Dan Duriscoe*

Experiencing a night sky filled with a blanket of stars becomes increasingly difficult at national parks. The growing populations in the western United States and the spread of development into rural areas have made light pollution a significant management issue for the National Park Service. In 2002 the NPS Night Sky Team, composed of park scientists and managers, continued efforts to monitor and preserve dark night skies, focusing on strategies to address impediments to protection. Obstacles within the Park Service include a lack of awareness of light pollution as a threat to wilderness values and cultural heritage, an absence of baseline information about this resource, and inefficient facility lighting.

The team tackled the awareness problem with an outreach effort to park managers and the public. Research presented at a conference cohosted by the Night Sky Team demonstrates that artificial night lighting not only diminishes the visitor experience but also has ecological consequences, influencing the behavior, biology, and survival of animals. A National Public Radio program examined endangered night skies in national parks, and a special issue of the *George Wright Forum*, edited by Joe Sovick, chief of recreation and partnerships for the Intermountain Region, received widespread attention.

Collecting baseline inventories for several parks represented a major effort in 2002. Astronomers at the U.S. Naval Observatory and the Lowell Observatory (both in Flagstaff) provided invaluable assistance with the development of research methods. More than 40 data sets now cover many southwestern parks. Preliminary analysis of the data shows that near-pristine skies can be found in those areas farthest from major cities and describes impairment caused by light pollution sources. For example, data from Walnut Canyon National Monument, 8 miles from Flagstaff, Arizona, indicate that although light from the city obviously causes light pollution, the night sky is far darker than would be expected (see image). The community has adopted lighting ordinances and retrofitted many outdoor lights. Scientifically sound information is vital for tracking mitigation efforts and encouraging public support.




NPS PHOTO

This panorama shows light levels in the night sky over Walnut Canyon National Monument, Arizona. Although Flagstaff, population 75,000, is evident to the west, the sky is much darker than would normally be expected given the town's proximity and population. A coalition of observatories, government agencies, private companies, and the public has enacted lighting ordinances and retrofitted many outdoor fixtures to improve lighting efficiency. Scientific records like this are useful for tracking mitigation efforts and encouraging public support to preserve dark night skies.

In 2003 the Night Sky Team will expand efforts nationwide and seed individual inventory and monitoring networks with "satellite" night sky teams. ■

**chad_moore@nps.gov**
Physical Scientist, Pinnacles National Monument, California

**dan_duriscoe@nps.gov**
Forest Ecologist, Sequoia and Kings Canyon National Parks, California